CARE AND REPAIR OF FARM IMPLEMENTS

No. 5

GRAIN SEPARATORS

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AN ENORMOUS waste of grain and great loss of time result every year through the inefficient work of thrashing machines that are not properly repaired and put in thorough working condition before the beginning of the working season.

Defective parts are overlooked or neglected in the hope that they will last through the season, when they should be replaced. When they fail in the midst of the season, serious losses often result before repairs can be made.

During or just before the thrashing season, new parts are difficult to get promptly because of the unusual rush of orders from the many who have procrastinated.

The separator should be overhauled at the close of the thrashing season or during the winter, needed parts ordered, and necessary repairs and adjustments made. This will tend to lengthen the life of the machine, and prevent loss of time and money from breakdowns at the busy season.

This bulletin gives instructions for overhauling and adjusting separators which will reduce to the minimum the losses and delays from breakdowns during the operating season.

No attempt has been made in this bulletin to give instructions on operating adjustments, as that subject was covered fully in Farmers' Bulletin 991, which may be obtained free of charge from the Division of Publications, U. S. Department of Agriculture.

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CONTENTS.

OVERHAUL MACHINES IN AMPLE TIME.

THRASHING-MACHINE OPERATORS should appreciate the necessity of repairing their machines and getting them in thorough operating order before the beginning of the thrashing season. But there still is a tendency on the part of far too many operators to delay such work until a few days before the "run" is started. As a consequence a great many separators are not properly overhauled and a large amount of unnecessary wastage of grain and consequent financial loss occurs. The resulting loss of time may be even more serious than the waste of grain.

If the operator will start the overhauling in time to make the repairs or to get new parts, he will be assured of a machine in good operating condition before going into the field.

While certain adjustments must be made during operation, it is possible by laying by the machine properly at the close of the season and overhauling in sufficient time in advance of the new season to have all parts in such condition that the necessary operating adjustments can be made readily, accurately, and with little delay.

CYLINDERS.

Too much care can not be taken in seeing that the cylinder is in good shape for thrashing.

Teeth.—Probably the first thing to consider is the teeth. If they are badly worn, they should be renewed. Any bent or damaged teeth should be replaced.

Each tooth should be tapped lightly with a hammer to determine by the sound whether it is tight. Any loose tooth should be driven firmly in place with a heavy hammer and the nut drawn tight against the bar or spring washer.

Keys.—Inspect the keys that hold the cylinders to the shaft and see that they are firmly in place.

Bearings.—Examine the bearings and, if worn, remove the shims and take up the bearing to a good snug fit, but not so tight that the cylinder will not turn freely. Be careful to see that oil holes or pipes are clean. If the babbitt is badly worn or scored, it is best to rebabbitt the bearings, as explained later.

Smoothing the shaft.—If the shaft is scored the rough corrugations should be smothed down with a fine file. The filing may be done in one of two ways or by a combination of the two.

The first method is to use the file at right angles to the axis of the shaft, giving the file a circular motion that will follow the surface of the shaft. This circular motion is given by lifting up on the front of the file and bearing down on the back or handle end. Used by a skilled man, this method makes it possible to keep the shaft round, or even to true it up in case it has gotten out of round. A good job can not be done by bearing down on the front end of the file and lifting up on the handle end, as is the common practice.

The second method is to "draw-file" the shaft by grasping the file at both ends and drawing it edgewise and along the axis of the shaft. This does not assist in truing up the shaft, but does take out scorings and, as the file marks are parallel with the axis of the shaft, the operation of the shaft tends to smooth out the marks.

The contrary is true of the marks left by the first method of filing. These marks extend around the shaft, and the tendency is to increase them rather than to smooth them out. A combination of the two methods in the order given should produce good results.

Adjusting the cylinder.—After the bearings are put in condition they should be bolted to the frame of the machine so that the distance between the frame and the ends of the cylinder is the same on each side. Care should be taken to leave a little end play in the cylinder to prevent the ends of the bearings from heating. If a single thickness of ordinary wrapping paper be placed at each end of the cylinder between the cylinder and bearing and removed after the bearing is tightened to the frame there will be enough end play.

Balancing the cylinder.—If it is necessary to replace many of the teeth the cylinder should be taken out of the machine and balanced. This is necessary to insure smooth and quiet running and to prevent uneven wear on the bearings. To balance the cylinder a pair of strong, rigid sawhorses should be obtained and a piece of smooth steel fastened edgewise, by means of blocks, to the top of each horse. This piece of steel should be at least 12 inches long to allow the cylinder to roll. Set the sawhorses far enough apart and parallel to each other, so that the cylinder will swing between them with the ends of the shaft resting on the steel plates. Before placing the cylinder the horses should be leveled both ways until the tops of the plates are exactly level, then place the cylinder and allow it to turn until it comes to rest. Make a mark on the topmost tooth and roll the cylinder over and again allow it to come to rest. Note the position of the marked tooth. If it is the same as before, it will indicate that the opposite side is heavy. To counterbalance this either put new teeth in on the light side until the cylinder is balanced, or, if new teeth are unnecessary, balance by driving wedges under the bands, preferably under the center band.

If provision is made in the cast ends of the cylinder for lead counterweights, slugs of lead should be driven into these holes until the cylinder is

balanced. To be in perfect balance the cylinder should come to rest at any point. Should the cylinder give too much trouble by being unbalanced, it will be best to send it back to the factory for balancing.

CONCAVES.

Concave teeth should be inspected the same as cylinder teeth. All those badly worn or badly damaged should be replaced. Loose teeth should be driven firmly in place and tightened. Care should be taken, however, if the concave bars are of cast iron, not to break them while driving in the teeth.

Adjusting the concaves.—To adjust the concave, see that the groove in the circle is clean of chaff and dirt; place all the bars in the circle, and turn the cylinder slowly by hand. There should be about one-eighth inch space between the cylinder teeth and the concave teeth. If the concaves appear to be too far to one side they should be moved over by means of the set screws on the outside of the machine. After the concaves have been moved over until the majority of the teeth are centered, any remaining teeth which do not center may be tapped with a heavy hammer to spring them until they come into proper position. This applies not only to concave teeth, but to the cylinder teeth, if they appear to stand at an angle to the bar. If the space between the teeth is less than one-eighth inch, cracking of grain will occur.

Raising and lowering mechanism.—Make an inspection of the mechanism for raising and lowering the concaves and see that it is in good condition and working freely. If a cam or eccentric is used for raising the front of the concaves see that it is not worn too badly to bring the concaves to their highest desired position. If badly worn, these eccentrics should be replaced with new ones.

Back end of concave.—Where adjustment is provided for the back end of the concave it should be inspected and put in good working condition. If hung by rods and adjustment made with screws and nuts, see that the threads are clean and of sufficient length to allow the concaves to move up and down the desired distance.

SEPARATING GRATES.

Inspect the grates and see that the bolts holding the sections together are tight, that the spacers are all in place, and the bars straight. Straighten bent bars. If the separating grates consist of rods or fingers they should be tightened if loose, and, if bent or kinked, should be brought to their original shape.

If the grates are adjustable, the adjusting mechanism should be inspected and made to work freely, for on machines which are designed with adjustable grates the position is very important for proper separation of the grain.

THE FEEDER.

A careful inspection of the feeder should be made, as good thrashing can not be done if this part of the machine is not working properly. Too heavy feeding causes the grain to be carried over and too

light feeding is unprofitable because it does not get the maximum output from the machine.

Framework.—Inspect the framework and see that all bolts and braces are tight. Any split or badly worn woodwork should be replaced. Where metal parts are fastened to the wood see that the bolts or rivets are drawn up tight to prevent play and splitting of the wood. Be sure that all bearings or boxings are fastened securely to the frame. If badly worn they should be rebabbited if possible, and if not, a new bearing should be supplied.

The slats and chains or belts of the carrier, whichever are used, should be gone over and any worn or damaged part repaired or replaced if necessary. Broken slats should be replaced with new ones. If split near the rivets a slat may be repaired by drilling a hole through it and drawing the parts together with a rivet.

If the rollers are split or badly checked they should be repaired by drawing the checks or cracks together with countersunk rivets.

Where chains are used, badly worn links should be replaced; however, it is possible in some cases to take up part of the wear and prolong the life of the links by bending down the lip or hook, thus preventing the chain from coming apart.

The adjusting mechanism for tightening the carrier should be brought to a good working condition so that equal tension may be brought upon each side of the carrier to insure good running. This is particularly true of the feeders which use a solid canvas and slats for the carrier.

Rotating band cutter.—If a rotating band cutter is used, the blades should be kept sharp. The self-sharpening kind should be inspected to see that the teeth are not badly broken or worn off. In either case the blade should be replaced.

Reciprocating band cutter.—If the reciprocating band cutter is used care should be taken to see that the knives are in good condition and fastened securely to their carrier by bolts or rivets as the case may be. The bearings, which are usually of wood, should be inspected and taken up to fit the crank. This may be done either by removing shims or planing a small portion from the edges of the box. These bearings always should be kept in good condition, as a loose bearing if neglected is apt to break or bend the shaft.

Retarder.—If the feeder is equipped with retarding forks or blades they should be gone over carefully to see that all bolts are tight and that the boxings are in good condition. These boxings usually are of wood and may be adjusted in the same way as those of the reciprocating band cutter.

Examine the fingers or blades of the retarder and see that they are not bent or broken. If broken they should be replaced, and if bent straightened to their proper form. Where the retarder is driven with cranks similar to those of the reciprocating band cutters the adjustments of the bearings will be the same as for the cutters.

Feed bottom.—The vibrating feed bottom should have all bearings and connections tightened up and the fishbacks bolted or screwed securely in place.

Governor.—The governor should be inspected to see that it is free from dust and dirt which would interfere with its proper working. If it is of the type having friction disks, these should be inspected and if badly worn renewed. This friction disk type of governor also requires the stud pin and sleeve to be in good condition for sensitive work; therefore, if on inspection these parts show wear they should be replaced with new ones. Any attempt at makeshift bushings or sleeves should be avoided. The two sets of weights

which go with this governor should be used and no substitute allowed unless the operator is very familiar with the machine.

Leathers.—Replace lost or badly worn leathers or flats, provided to prevent the straw from winding on any of the crank shafts, on the feeder or elsewhere about the machine. Old leather belting may be used for this purpose.

CHAIN RAKES.

If the machine is equipped with a chain rake or raddle see that the bearings are in good shape and that the slats and chains are in good condition. Any broken or damaged slats should be replaced with new ones. See that the adjusting mechanism, which usually consists of a screw on each side of the machine, is in good working condition so that the chains on each side may be kept at equal tension with the slats running squarely with the machine.

BEATERS.

Examine beater bearings to see that they are in good condition. See that the beater is centered in the machine; that is, that there is equal space at each end of the beater between it and the frame of the machine. See that the keys or set screws are firmly in place. If the beater is made of or faced with sheet metal, see that there are no rough edges or projections which will catch and wind the straw. If the beater has wooden blades, those that are split or badly worn should be replaced; if of cast sections, see that the bolts holding these sections to the shaft are tight and allow no play of the section.

Timing.—If twin beaters are used be sure that they are properly timed.

If the machine is equipped with a beater or separating device for further separating out grain and for tearing apart and spreading the straw as it passes over the racks, see that the fingers or blades are timed so that they are pointing down at all times.

Fingers.—Any broken fingers should be replaced with new ones and any loose nuts tightened. Fingers must be spaced equally on the shafts to obtain an even distribution of the straw.

Placing gears.—If it is necessary on this beater to remove gears for repairs the best and quickest way to insure getting them back in their proper positions is to make a mark on the end of a tooth and a similar mark opposite this tooth on the gear with which it meshes. This mark may be made with either a prick punch or cold chisel. If a chisel is used, the mark may be made by letting the edge extend across from one gear to the other. If a prick punch is used, a dot or number of dots can be made on the tooth and a similar number on the gear opposite just at the end of the marked tooth.

Grates or fishbacks.—Grates or fishbacks under this beater or separator should be inspected and loose bolts or screws tightened to prevent the parts from becoming loose and interfering with the fingers and to insure a steady flow of the straw.

APRONS OR CHECK BOARDS.

Inspect the curtains or aprons and see that they are fastened properly to the roof of the machine. If canvas curtains are used, replace

any torn or badly worn. A piece of canvas soaked in hot linseed oil is the best material for this purpose. If metal or wood check boards are used, the hinges, if any, should work freely to allow the board to swing and permit raising and lowering the board, if adjustable. If the curtains or check boards are provided with adjusting straps, see that such straps are in working condition; if not, replace with new ones.

STRAW RACKS OR SHAKERS.

Inspect the straw racks for broken slats, fingers, and fishbacks. Replace with new any that are broken. If any of the fishbacks are faced with strap iron, see that the nails are driven securely and that the ends of the strap iron are held close to the wood so they will not catch and retard the straw.

Crank bearings.—Examine all the crank bearings carefully and see that they are tight. These bearings usually are of wood and can be taken up in the same manner as those on the cranks of the feeder. Some, however, have provision whereby the two parts of the box are held together by a wedge. In this case tighten the screw which drives the wedge in until the box is tight, and set the locknut on the set screw.

Framework.—If the framework for the racks is broken or split the parts should be replaced with new ones.

Links.—If wooden links or hangers are used to carry the straw racks the wear on the bearings can be taken up by tightening the bolt or rivet, as the case may be. However, if the link is too badly worn, it should be replaced by a new one. If metal links are used, the wear may be taken up by means of the set screw in the end of the link; or if no adjustable box is provided, a new link should be put on.

Pitmans.—The pitmans should be inspected and bearings put in good shape. These bearings, usually of wood, are tightened either with a set screw or two bolts, which draw the sections together. Care should be taken that the two pitmans be kept of exactly the same length, otherwise the straw racks are apt to be warped out of shape and the joints weakened.

GRAIN PAN (CONVEYOR).

See that the frame of the grain pan is in good condition and works freely in the separator frame. If the bottom is of wood see that the slats are in good condition and all nails driven in. Any broken or with holes should be replaced. If the bottom is of metal see that it is tight on the frame and that there are no holes either punched or rusted in it. If longitudinal slats are provided for guiding the grain as it passes back over the pan they should be in their proper position. If loose or warped, nail them back in their proper place.

Shields.—See that the canvas or wood shields, which prevent the grain from dropping down between the separator sides and the pan, are in good condition. If of wood they should be kept screwed tight to the separator side, and if of canvas, they should be replaced if badly worn or torn.

Hangers.—See that the bearings on the hangers or links are in good condition and that the grain pan is level crosswise with respect to the separator.

If these hangers are adjustable and if any changes are made on one hanger be sure that the one on the opposite side of the machine is taken up or let out in the same proportion.

CHAFFER.

Inspect the chaffer frame and see that it is in good condition. If made of slats, replace those broken. If an adjustable metal screen is used, see that the blades are in good condition and respond to the adjusting mechanism. Where the chaffer is attached to the grain pan see that the bolts joining them together are tight to prevent the chaffer from being racked and broken.

CLEANERS.

Inspect all sieves and screens. See that the frames are in good shape and not warped, and that all corner clamps and wear plates are tight. Be sure that the adjusting mechanism for the sieve works freely. Examine wire screens for damage either by rust or rough handling, and if badly damaged, new screens should be obtained, or at least the metal part replaced.

Shoe.—Examine the shoe carefully; see that the castings which carry the sieves and screens are in good condition and fastened securely to the shoe. If any additional adjusting mechanism for raising or lowering the sieves or screens is attached to the shoe, see that its fastenings are in good condition and that it is working freely.

Examine the shoe pitmans and bearings and tighten if necessary, but be sure that each side is adjusted the same, for, if one pitman is longer than the other, grain will be thrown to one side and good cleaning can not be accomplished.

Shelves and rollers.—If the machine is of the type using shelves and rollers for cleaning the grain, instead of screens and sieves, the castings carrying the shelves and rollers should be inspected for any damage, and to see that the shelves work freely and that all vibrating mechanism is in good condition.

If wooden rollers are used, any broken corrugated sections should be replaced, as should wood shelves that are split or warped.

All adjusting and locking mechanism should be put in good working order.

FAN.

Examine the fan housing to see that it is not rusted through, if made of metal, or, if made of wood, that none of the boards or slats are broken. See that the fan doors are in good shape and work freely in their guides, and that the locking mechanism holds the doors in any desired position. If the doors are broken or badly warped they should be replaced by new ones, though in some cases it is possible to interchange or reverse the doors and have them work satisfactorily.

Bearings.—Examine the fan bearings and if worn take up by removing shims. If this can not be done, have the bearings rebabbitted.

Blades.—If any of the fan blades are split or broken replace them with new ones. It is best to get these blades from the manufacturer to insure getting

material of the same weight as the other blades, thus keeping the fan in balance. Examine the set screws or keys which hold the spiders and see that they are tight. Also be sure that the ends of the fan blades do not strike the ends of the housing. In most machines the end play of the fan can be adjusted by loosening the set screws in the collars next the bearing and sliding the shaft to the desired position.

Wind boards.—If wind boards are used for controlling the blast, see that they are not broken and that they respond to any adjusting mechanism. If the blast board is adjusted automatically, see that the dash-pot governor is working freely; if not, the board should be examined to see that it is swinging freely, and if this does not remedy the trouble examine the dash pot and give it plenty of oil.

On some machines fan doors are not used, but the end of the fan housing is screened to keep out coarse foreign material.

GRAIN AUGERS AND ELEVATORS.

When auger troughs upon examination prove to be rusted through, they should be replaced with new ones. If dented, the dents may be beaten out with a wooden mallet, provided a wooden block is held opposite the dent to keep from warping the trough. If the auger bearings are badly worn they should be replaced with new, unless provision is made for taking up the bearings, which is not the case on most machines.

Elevator housing.—Examine the elevator housing, which must be securely fastened to the frame of the machine. If it is loose, the braces should be gone over carefully and new bolts and screws provided where needed. If the chain in the elevator does not run smoothly or has a tendency to bind or jump, examine the inside of the housing and see that it is smooth; if not, it should be repaired either by replacing the bottom board in case a wood housing is used, or, if a metal housing is used, by determining whether the drag is caused by a bad dent or by the metal being rusted through, and remedying the defect. This may be done, in the latter case, by using a new tube or bottom, while if only a dent is the cause it may be removed by placing the tube on a smooth bench and rolling the dent out with a heavy shaft. If a flat metal bottom is badly cupped or sags in the center until the drags do not get all the grain, it should be beaten back into place with a wooden mallet if possible; if not possible to beat it back, a new bottom should be provided. See that the drag blocks or plates are all on and fastened securely; if not, they should be reset and riveted on. If the chain shows excessive wear it is best to replace it with a new one, although its use may be extended temporarily by closing the hooks or lips.

Vibrating screen.—If there is a vibrating screen on the underside of the housing, see that the vibrating mechanism works the screen properly and that the screen material is not rusted or worn through; if so, it should be replaced. See that the spout which carries the grain back into the separator is in good condition.

Chain tightening.—See that the chain-tightening mechanism, which is usually at the top of the elevator shaft, is in good working condition and that it takes up equally on each side. This insures the chain running true and eliminates excessive wear.

Safety friction drive.—If the safety friction driving mechanism is used to drive the elevator chain, test this mechanism by locking the chain and turning

the belt pulley. If the mechanism is stuck and will not allow the pulley to turn, it should be taken apart and cleaned and any broken or badly worn parts replaced.

STACKER.

Examine the fan housing, to see that it is not rusted through at the bottom. If rusted, a plate should be riveted over the hole on the outside. Examine the fan bearings; and if loose, take them up by removing shims; or if badly worn, have them rebabbited. If the shaft is scored, remove the corrugations or ridges by "draw filing," as explained under "Cylinders."

Fan blades.—Examine the fan blades to see that the bolts holding them to the spider are tight, and that the spider is keyed rigidly to the shaft. If the fan blades are bady worn, it is best to replace them with blades from the factory to insure getting them of the proper weight, thus keeping the fan in balance. This is very essential, since this fan runs at a very high rate of speed and if out of balance the bearings are apt to wear rapidly and the framework is racked.

Fingers.—If there are spiral fingers on the shaft for feeding the straw uniformly to the fan, see that they are tight on the shaft and properly spaced. If a finger is provided on the fan grid for preventing the straw from bridging the intake opening, be sure that the nuts are drawn tight to prevent the finger from coming loose and being thrown through the housing.

Turret mechanism.—Examine the turret mechanism; see that all bolts are tight and no castings broken. Defective parts should be replaced by new ones. Any part of this mechanism that acts sluggishly usually can be relieved by applying oil or grease freely.

Tube elevating mechanism.—See that the screw or mechanism for elevating the stacker tube is working freely throughout its entire length of travel. If cables are used on this mechanism, see that no strands are broken and that the cable is kept lubricated. If the cable has started to break or fray, it should be replaced with a new one.

Telescoping mechanism.—Examine the telescoping mechanism and see that it is working freely. A rusty chain or rack and pinion is usually the cause of any difficulty in telescoping the stacker tube. This trouble may be overcome by turning the hand wheel and at the same time pulling on the chain or rack by hand.

Hood.—See that the sections of the hood telescope freely. If dented or bent, their condition may be improved by the use of a wooden mallet.

If the hood does not turn freely about the main tube, it should be worked by hand a few times, which usually will work out the dirt and chaff which is causing it to bind. If the ropes used for turning the hood or telescoping it are broken or rotten, they should be replaced by new ones.

Carrier stackers.—If a carrier stacker is used, see that the framework and sideboards are in good condition. Any split or badly warped boards should be replaced. If the floor is of metal, see that all nails are driven home and that no large punched or rusted holes are in it. In such case the section should be replaced with a new piece of metal. If the floor is of wood slats, examine the slats and see that none is badly slivered or broken. Any so damaged should be replaced. Examine the rollers and bearings. If the bearings are badly worn, new ones should be provided. If the rollers are checked or split,

they should be drawn together with countersunk rivets and any rough edges removed from the wood with a rasp.

Replace with new ones any broken or badly damaged slats.

Examine the elevating mechanism and see that it is in good condition, and that it is adjusted to keep the elevator sides even.

TRUCKS AND FRAMES.

See that all bolts and braces holding the framework of the machine are tight. If the machine has been allowed to stand over winter on uneven ground, the frame is apt to warp. This may be adjusted by means of the diagonal braces running across the top of the machine just under the roof. Some machines also have diagonal braces on the sides.

Wheels.—Examine the wheels and see that grease is being fed to the axle if a grease cup is used. If the wheel is "built up" see that all spokes are tight; if not, they can be adjusted by screwing the spoke into the hub and tightening upon the lock nut.

WEIGHER AND BAGGER.

Examine chains and cups in the elevator and see that they are in good condition. If any of the cups have become mutilated in any way they should be replaced with new ones. If the chain is badly worn, the lip or hook of each link may be closed down to prevent the chain from coming apart. If the sprocket wheels at either the top or bottom engage only every other link, care should be taken when shortening up the chain to remove two links at a time as, with this particular chain, the removal of only one link will throw the chain out of mesh and may break it. If it is not possible to remove two links the only thing to do is to tighten the chain as much as possible with the tightening mechanism.

Weighing mechanism.—Examine the weighing mechanism; see that the hopper swings freely and that none of the moving parts rub against any of the framework or interfere with each other. Occasionally parts become sprung and may be bent back to proper position. If any of the cast parts are broken or badly worn, the only safe thing to do is to replace them with new ones.

PULLEYS.

Any lagging on belt pulleys should be inspected, and if it shows buckling or looseness in any way the pulley should be relagged.

Relagging.—To do this remove the old lagging, and if wooden strips or wedges are set in the face of the pulley to which to nail the lagging, they should be replaced if split or loose. Select a good piece of belting a little wider than the pulley to allow for stretching, and from 4 inches to 6 inches longer than the distance around.

Soak the leather in water until it is thoroughly saturated and pliable. Then square up one end and nail or rivet, as the case may be, to the pulley; then with a pair of strong screw clamps, placed a few inches ahead of the next

wedge or set of rivet holes, clamp the belt firmly to the pulley; then close to the clamp drive, from opposite sides, long wood wedges between the leather and pulley face until the leather is stretched absolutely tight; then nail or rivet to the pulley. The clamps should set far enough in advance of the nailing or riveting point to insure that the driving of the wedges will not raise the lagging from the surface of the pulley where the fastening is to be done. The clamps are then moved ahead and the leather stretched for the next nailing or riveting place.

If the lagging is riveted on, care should be taken when punching the holes to punch them slightly back of the holes in the pulley face from the direction in which the belt is being pulled, so that they will tend further to stretch the leather when drawn up and riveted.

Do not attempt to stretch the leather around the whole pulley at once, as the surface friction would prevent the belt from slipping and stretching tight all the way around.

Clamps.—If screw clamps are not available, a good clamp can be made of two pieces of hardwood, preferably oak, and two $\frac{3}{8}$ by 5 inch bolts. The pieces of wood should be straight, $1\frac{1}{2}$ inches thick, 2 inches wide, and long enough to extend across and beyond the pulley to allow a bolt hole through each end. To use this clamp put one piece on the outside on top of the leather and the other on the inside of the pulley rim and draw together with the bolts. If the inside piece is placed so that it will be caught by a spoke, in case there is any slippage, delay in tightening the bolts is avoided. However, the cast wheel rim is usually rough enough to prevent this slipping if the bolts are reasonably tight.

Pulleys.—Of all the wheels on the machine the drive pulley, owing to the heavy duty put on it, probably is the hardest to lag successfully. If a great amount of trouble has been experienced with it, it is best to replace it with a paper pulley. These pulleys are not only practically indestructible but they do not require lagging and give excellent service.

The slippage of a belt at high speed is often due to the presence of a cushion of air between the belt and pulley surface. This may be remedied in the case of unlagged iron pulleys by cutting grooves around the face, by drilling small holes about $\frac{1}{8}$ inch diameter through the pulley face, or by a combination of the two.

Never allow a key to project beyond the end of the shaft, as it may cause accidents.

Any pulleys that are damaged to the extent of requiring new ones should be replaced by pulleys of the same dimensions as the originals. The manufacturers of the machine have very carefully calculated the size of each pulley to drive its particular part of the machine at exactly the right speed to do the required work, consequently a change in the diameter of any one pulley will, through changing the speed, most surely change the movement of the driven part and in this way throw a heavier duty on some of the other parts.

BABBITTING BEARINGS.

If any of the split or two-piece bearings need rebabbitting the following process is recommended:

Preparation.—Remove the shaft, chip out all old babbitt and clean the bearing with gasoline. Wrap a sheet of paper smoothly around the shaft and stick the lapped ends together with mucilage, replace the shaft in the bearing, line it up carefully and block securely in place. Put stiff putty, or clay, around the shaft to close up the end of the bearing and keep the hot metal from running

out. Make putty, or clay, funnels at the top of each end of the bearing. These funnels are either for pouring metal into the bearing or for permitting escape of air and also allowing the hot metal to rise to a level above the top, thus furnishing the surplus to take care of the shrinkage as the bearing cools. If a pouring hole is not provided in the casting, the metal may be poured into either funnel, the other being left open to allow the air to escape while pouring.

To get smooth ends.—To get good, smooth, and better looking ends of the box, especially on large split bearings, than if the putty alone is used, cut cardboard washers to slip tightly on the shaft and with an outside diameter a little larger than the diameter of the hole to be babbitted; place one of these at each end of the bearing and cover with putty, being careful to seal tightly all the way around the washers except at the top where notches can be cut, opening to the funnels. The paper leaves the end of the bearing smooth and true.

Pouring.—The box may be made in two sections by pouring the bottom half first and allowing it to cool, then bolting on the top section and pouring it, or the whole box may be run at one time. In either case cardboard shims or liners should be put in when the box is put together. These shims should extend in against and along the shaft to make a joint between the two halves and to allow the box to be taken up when worn.

When the whole box is run at one pouring, in order to allow the metal to run from the top half to the bottom cut four or five V-shaped notches in the edges of the shims next the shaft. These notches are not necessary when the bottom half has been run first. After the box has been poured and the metal cooled the bolts holding the sections together may be removed and the two halves split apart with a cold chisel. Remove all sharp edges from the babbitt with a chisel or file and try the shaft after removing the paper wrapping for a fit. If a light coat of oil mixed with lampblack be smeared on the shaft and the shaft revolved, the lampblack will catch on the high points of the babbitt, then by removing the shaft and scraping off these high spots a good bearing can be produced. However, it is sometimes necessary to repeat this operation several times to get a good, even bearing surface.

Oil grooves should be cut with a round-nose chisel extending radially from the oil hole to near the edges of the bearing. These grooves should, if possible, be on the opposite side of the bearing from which the pressure, due to the belt pull, comes. Locate the groove so as to insure an even distribution of the oil through the length of the bearing.

The solid box may be prepared and poured the same as a split box, except that no shims or liners are used. Care should be taken that the end of the shaft is not scarred or battered, which will prevent its being pulled through the box after the metal has cooled.

The babbitt for good pouring should be hot enough to brown the end of a white pine stick when dipped in it or when the color is just changing from silver to a yellow tint on the top. Be sure to have enough metal to pour the bearing until it rises into the funnels at the ends, as the stream should remain unbroken during the pouring in order to prevent formation of joints. Sometimes for extremely accurate work the shaft is covered with lead paint or smoked instead of using the paper wrapping, but this method is more difficult than using the paper, especially if the shaft must be pulled out of the bearing, as in the case of a solid box.

If the weather is cold the parts should be warmed before the babbitt is poured. This will prevent excessive shrinkage and possible cracks due to rapid cooling.

In every case the bearing should be dried thoroughly before the babbit is poured. Serious burns have resulted through failure to observe this precaution.

BELT LACING.

The drawings in figure 1 show some of the more common methods of belt lacing.

Lacing material.—The most common lacing leather is rawhide or "whang," but some is of special tanning. There are various patented metal belt fastenings, some of which are good, while others cause considerable trouble. The soft-wire lacing gives good satisfaction and requires practically the same system of holes and lapping of the strands as the rawhide. This wire is very pliable and gives a small, neat joint.

Directions for lacing.—In the following directions for making the lacings illustrated the lacing should pass through the holes in the numerical order as given. The odd numbers indicate holes looking from the grain side of the

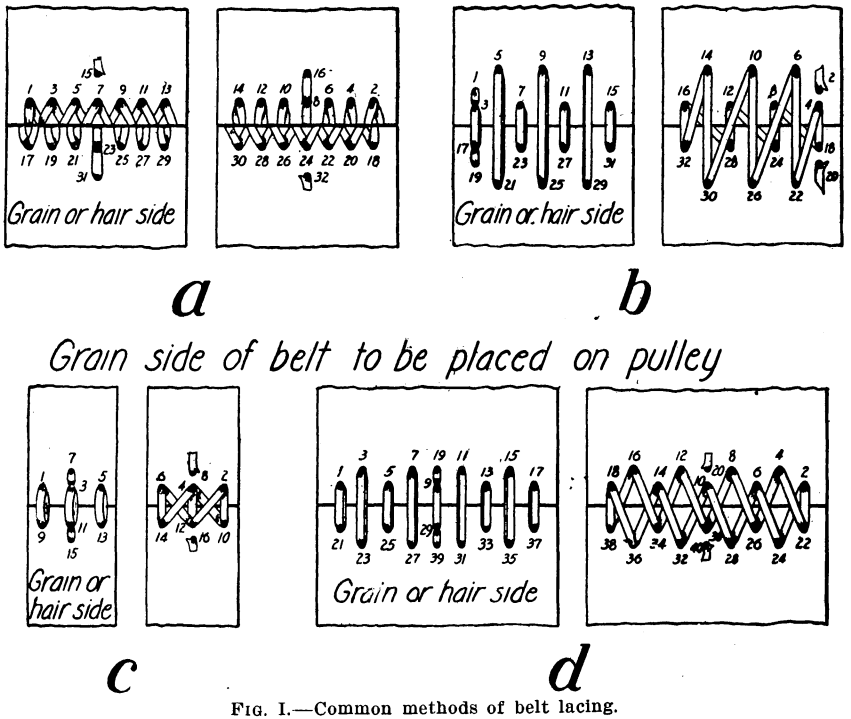

FIG. I.—Common methods of belt lacing.

belt and the even numbers looking from the flesh side. Thus No. 1 and No. 2 are the same hole, but No. 1 is seen from the grain side and No. 2 from the flesh side.

Hinge lacing.—The drawings marked *a* show a hinge lacing, which is good where a tightener is used on the belt or where both sides of the belt come in contact with pulleys. For this hinge lacing the following order of threading the holes should be observed: Draw one end of the lace through 7–8 and pull the ends even, then for the left-hand side, with the grain up, thread the holes in the following order: 7, 23, 5, 21, 3, 19, 1, 17, 1, 17, 3, 19, 5, 21, 7, 16; then if the belt is turned over with the flesh side up, the order of threading should be as follows: 8, 26, 10, 28, 12, 30, 14, 30, 14, 28, 12, 26, 10, 24, 31.

Lacing for medium-width belt.—The drawings marked *b* show a common lacing for a medium-width belt. The threading should be done as follows:

Start the lace through the hole 15, 16, pull the ends even, and then thread the holes in the following order: 15, 28, 11, 28, 11, 24, 7, 24, 7, 18, 3, 18, 19. The threading on the flesh side should be as follows: 16, 31, 16, 31, 14, 29, 14, 29, 10, 25, 10, 25, 6, 21, 6, 21, 4, 17, 14, 1.

Lacing for narrow belt.—Lacing *c* is for narrow belts. Start the lace through 3, 4, and pull the ends even, then thread the holes as follows: 3, 10, 1, 10, 1, 12, 15, 4, 11, 4, 11, 6, 13, 6, 13, 4, 7.

Lacing for wide belt.—Lacing *d* for wide belts is laced as follows: Start the lace through 9, 10, and thread through 9, 32, 11, 34, 13, 36, 15, 38, 17, 38, 17, 36, 15, 34, 13, 32, 11, 30, 39. The flesh side will then be as follows: 10, 29, 8, 27, 6, 25, 4, 23, 2, 21, 2, 21, 4, 23, 6, 25, 8, 27, 10, 19.

Finishing the lacing.—In finishing up a lacing to keep the lace from coming loose, pull it through the last hole and notch it, as shown, to keep it from working back through the hole. The belt should be bent and the lace pulled through far enough to insure that the butt end of the notch catches the edge of the hole when the belt is straightened out.

Holes for lacing.—The distance the holes should be punched from the ends of the belt depends somewhat on the quality of the leather, but preferably should be about $\frac{3}{4}''$ to $\frac{7}{8}''$ and in no case less than $\frac{1}{2}''$ from the ends or the edges of the belt. Where the double rows of holes are used the back row should be at least $\frac{3}{4}''$ from the first row. In this case the lateral distance between holes in a row should be about $1\frac{1}{4}''$ and the holes in the rows staggered, thus bringing the parallel strands of lace about $\frac{7}{8}''$ apart. However, this dimension may be varied somewhat either way.

Lacing holes in leather belting always should be made with a belt punch and never with an awl or knife, as either of these instruments is very apt to make rough holes, not uniform in size, and much more liable to tear out than the punched hole.

In lacing a canvas belt it is best to make the holes with a large awl, rather than a punch, as then the threads are spread apart and not broken, which weakens the belt.

HOUSING.

When "laying by" the machine, immediately after the thrashing season is over, the separator should be cleaned thoroughly with a stiff brush, both inside and out, to remove all collections of chaff and dirt.

Oiling the outside.—After cleaning the outside of machine, go over the entire surface, whether of wood or steel, with pure linseed oil, particularly the seams and joints. The bearings and parts which receive oil or grease should have the dirt and grease scraped and wiped from them. Kerosene will assist materially in this cleaning process, and the parts will be left dry and in good condition for inspection and repairs.

Oiling concaves and wearing parts.—The concaves should be removed from the holders and, after cleaning out all chaff and dirt, should be gone over with a brush, using machine oil as a protective coating. The concaves may then be removed easily when starting up the separator the following season.

Exposed metal wearing parts should receive a coat of oil or grease.

Paint.—Nonwearing metal parts and all wood portions of the separator should be given a coat of some protective material. A good quality of paint is the best thing to be used for this purpose. If painting is not feasible a coating of oil or grease should be given to the metal parts and linseed oil to the wood parts. It should be borne in mind, however, that paint is one

of the best protectives that can be used on nonworking surfaces, either metal or wood, and should be used as frequently and often as needed.

Housing under roof.—The machine should be housed in a shed or barn with a good roof where it will not be exposed to the sun or rain. Care should be taken that the ground or floor is level to avoid warping of the frame.

If the floor itself is not level, the wheels should be firmly blocked up to bring the separator level in both directions.

Tarpaulin.—If a tarpaulin cover is available the separator should be covered with it, not only as a protection from possible dampness, but also from dirt which will accumulate moisture and thus cause rot or rust.

Storing belts.—All belts, whether leather, canvas, or rubber, should be taken off and inspected. Such as show signs of any weakness should be laid aside for repairs. The others should be cleaned of any collection of dirt and grease and then rolled up, tied, and, in the case of leather belts, stored in a dry place, free from rats and mice. Rubber belts, if dirty, should be washed and stored in a damp, dark place. The defective belts should be gone over and any bad lacings replaced.

Any glued parts of leather belts that are loose should be reglued. To do this the surface should be carefully cleaned of all dirt and old glue and if the belt is oily the oil should be removed by soaking in gasoline and the belt allowed to dry. A good belt glue should then be applied and the parts clamped tightly together between two smooth boards, held by means of a vise screw or clamps, or the boards, with the belt between, may be placed on the floor with heavy weights on top. The belts should not be removed until the glue is perfectly dry. The safe plan is not to disturb the belt for at least 24 hours. Riveting the joints should be avoided, as the rivets are very apt to corrode, weaken the leather, and pull out.

If any of the leather belts are dry and "husky" they should be washed in warm water and given a coat of melted beef tallow, applied just warm enough to run freely, or a coat of neat's-foot oil. A belt should not be soaked or saturated with grease or oil as too much causes the leather to stretch and the belt to slip on the pulleys.

Mineral oils should not be applied to belts under any circumstances.

Web or canvas belts should be cleaned and stored in a dry place. If dry, a coat of castor oil will improve them.

Extra repair parts, which should include concaves, cylinder and concave teeth, chains, belt lacing, etc., should always be kept on hand for immediate use. This will often save much time and trouble.

ILLUSTRATIONS.

The illustrations shown as figures 2 and 3 are made from composite drawings in which various parts have been selected at random from among a wide variety of separators. Neither cut illustrates any particular make of separator, nor is the fact that any particular part is illustrated to be construed as a recommendation of that part by the Department of Agriculture. The sole purpose in using cuts is to provide a means of identifying the various parts in making repairs and adjustments and in ordering new parts.

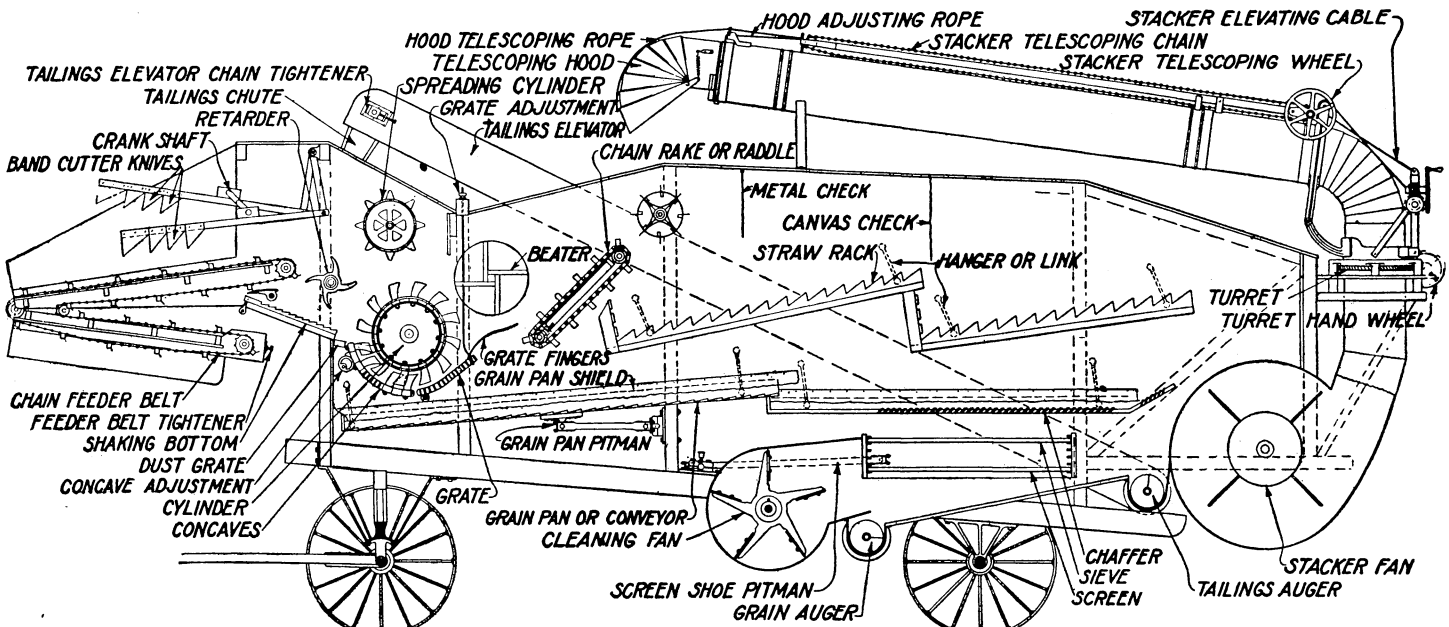
HOOD ADJUSTING ROPE
STACKER ELEVATING CABLE
HOOD TELESCOPING ROPE
STACKER TELESCOPING CHAIN
TELESCOPING HOOD
STACKER TELESCOPING WHEEL
TAILINGS ELEVATOR CHAIN TIGHTENER
SPREADING CYLINDER
TAILINGS CHUTE
GRATE ADJUSTMENT
RETARDER
TAILINGS ELEVATOR
CRANK SHAFT
CHAIN RAKE OR RADDLE
BAND CUTTER KNIVES
METAL CHECK
CANVAS CHECK
BEATER
STRAW RACK
HANGER OR LINK
TURRET
TURRET HAND WHEEL
GRATE FINGERS
GRAIN PAN SHIELD
CHAIN FEEDER BELT
FEEDER BELT TIGHTENER
SHAKING BOTTOM
GRAIN PAN PITMAN
DUST GRATE
CONCAVE ADJUSTMENT
GRATE
CYLINDER
GRAIN PAN OR CONVEYOR
CONCAVES
CLEANING FAN
CHAFFER
SIEVE
SCREEN
STACKER FAN
SCREEN SHOE PITMAN
TAILINGS AUGER
GRAIN AUGER

FIG. 2.

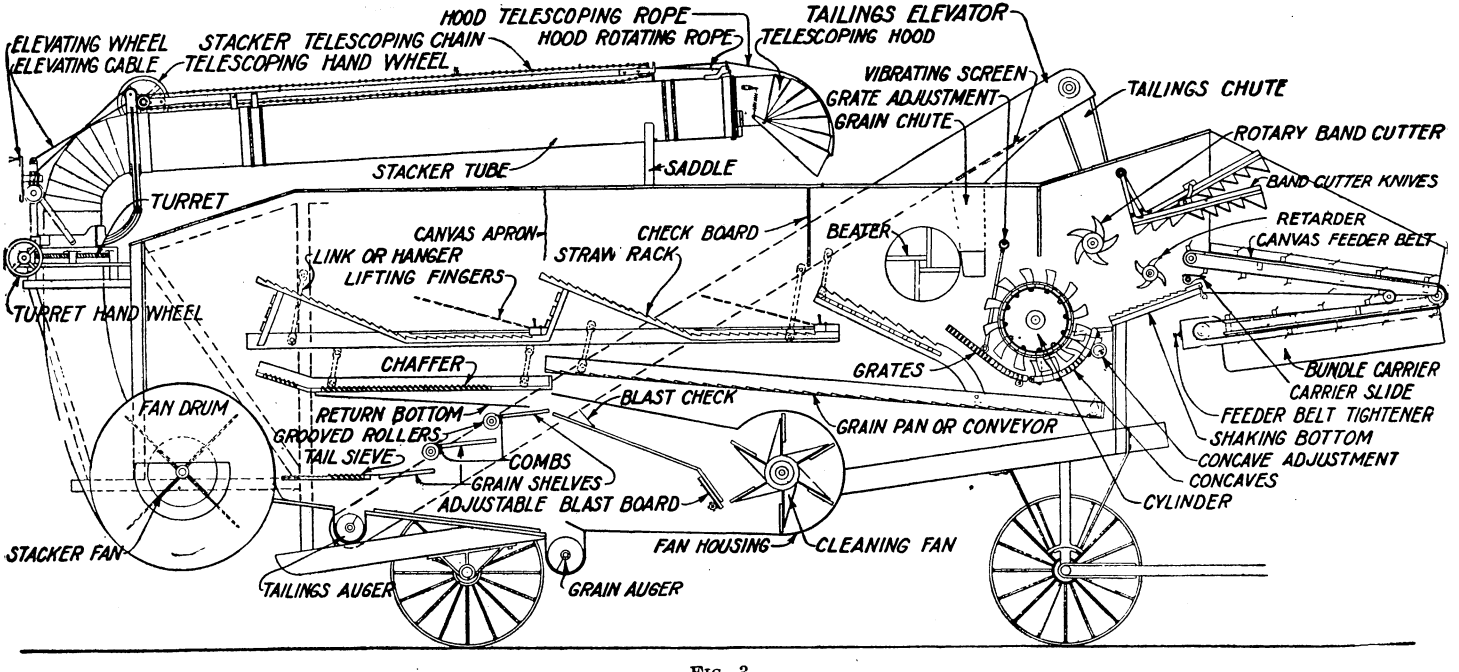
HOOD TELESCOPING ROPE
TAILINGS ELEVATOR
ELEVATING WHEEL
STACKER TELESCOPING CHAIN
HOOD ROTATING ROPE
TELESCOPING HOOD
ELEVATING CABLE
TELESCOPING HAND WHEEL
VIBRATING SCREEN
TAILINGS CHUTE
GRATE ADJUSTMENT
GRAIN CHUTE
ROTARY BAND CUTTER
STACKER TUBE
SADDLE
BAND CUTTER KNIVES
TURRET
RETARDER
CANVAS APRON
CHECK BOARD
BEATER
CANVAS FEEDER BELT
LINK OR HANGER
STRAW RACK
LIFTING FINGERS
TURRET HAND WHEEL
CHAFFER
GRATES
BUNDLE CARRIER
CARRIER SLIDE
FAN DRUM
BLAST CHECK
RETURN BOTTOM
GRAIN PAN OR CONVEYOR
FEEDER BELT TIGHTENER
GROOVED ROLLERS
SHAKING BOTTOM
TAIL SIEVE
COMBS
CONCAVE ADJUSTMENT
GRAIN SHELVES
CONCAVES
ADJUSTABLE BLAST BOARD
CYLINDER
STACKER FAN
FAN HOUSING
CLEANING FAN
TAILINGS AUGER
GRAIN AUGER

FIG. 3.

These cuts are not intended as substitutes for those furnished by the individual manufacturers, from whom each owner or operator should secure an illustrated instruction book giving directions for the care and operation of his machine and also instructions for ordering repair parts.

Many of the manufacturers get out instruction books that cover the subject quite thoroughly and illustrate and name the different parts. These books should be studied carefully and frequently and the instructions followed in making adjustments and repairs.

In ordering repairs care should be taken to specify the parts by the names given in the manufacturer's catalogue or instruction book, or by those shown on the cuts in this bulletin.

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